ATTACHMENT A: SUPPLEMENTAL INFORMATION ON UCB'S PROPOSED BS GENERAL ENGINEERING PLUS

This supplemental information is unrelated to the proposed Bachelor of Science General Engineering Plus degree's fit with UCB's statutory role and mission and educator preparation statutory performance measures. The following is summarized from UCB's proposal:

EVIDENCE OF NEED

Student Demand-- Data collected from current undergraduate engineering students suggests that a *General Engineering Plus* degree program is highly desired by our student population. As part of our degree feasibility study, a short-answer, Likert-scale survey was sent to the 3,382 current CU undergraduate engineering students in November 2012. The primary purpose of the survey was to assess undergraduate student interest in, and perceptions of, both General Engineering degree programs and secondary math or science teacher licensure to determine whether the BS GE degree program and/or the + CU Teach Engineering track should be added to our college's undergraduate degree offerings.

A total of 822 students responded to the survey, representing 24.3% of the undergraduate engineering population. Respondents were about evenly spread among the four cohorts, with 28% of the respondents' women and 72% men. The student survey results strongly support our college's pursuit that the first General Engineering "+" sequences be GE + CU Teach Math and GE + CU Teach Science. Student survey results also indicate that interest in a General Engineering degree is strong: 27% of respondents "agreed" or "strongly agreed" that they "would have been interested in enrolling in a General Engineering degree program at CU," including 30% of the female and 37% of the Hispanic respondents.

Degree Flexibility — Not surprising, a strong student desire exists for flexibility within their engineering degree program (a characteristic provided by the proposed *General Engineering Plus* degree program): 48% of survey respondents "agreed" or "strongly agreed" that they would "like the flexibility to customize [their] engineering degree program through an individualized, negotiated curriculum," including 53% of female and 66% of Hispanic student respondents.

Desire to Teach — Students also reported a strong interest in simultaneously pursuing secondary science or math teacher licensure with an engineering degree: 25% of survey respondents "agreed" or "strongly agreed" that they "would be interested in earning a grades 7-12 science or math teaching license while [they] earn [their] engineering degree," including 23% of men, 31% of women, and 42% of Hispanic students (see Table 4). For comparison, only 13% of students indicated the same level of interest in fulfilling medical school admission requirements, and only 8% of students had the same level of interest in attending law school after completion of their undergraduate engineering degree.

Contribution to Department and Campus Diversity-- We expect that the *General Engineering Plus* degree program and the plus *CU Teach Engineering* track will attract a *different kind* of

student to engineering—and thus broaden participation to include students typically under-represented in engineering. This expectation is informed by direct experience; for four years, we have been intimately involved in engineering recruiting, with a special emphasis on attracting women and minority students to engineering. In this short time, our work has *more than doubled* the number of minority engineering students entering our college. And, our experiences in talking with thousands of high school students leads us to believe that the *CU Teach Engineering* track will attract a new and *different kind* of student to engineering— students who otherwise might not have chosen an engineering path at all.

Workforce Demand-- Questions also surround the workforce demand for students graduating from CU-Boulder with a General Engineering degree. Data from the U.S. Bureau of Labor Statistics show that engineering disciplines are among the top growth fields, with projected new employment growth from 2010 to 2020 of 5%-62% in various engineering specialties. Post-graduation data for students completing a comparable general engineering degree program at MIT suggests that *General Engineering Plus* graduates would likely be faced with similar postgraduation opportunities as their peers who chose specialized engineering programs within the engineering college. Three MIT engineering departments offer general engineering degrees via "flexible" options: Mechanical Engineering, Aeronautics and Astronautics Engineering, and Chemical Engineering. MIT recently surveyed both their standard mechanical engineering graduates and flexible mechanical engineering graduates to explore what they *do* immediately after graduation (see Table 5). They also surveyed current students to ask about their plans, and their findings were consistent: both populations of students tend to do *exactly what they plan to do.*

DUPLICATION

In designing this degree program, we extensively benchmarked General Engineering and teacher licensure programs at institutions of higher education across the nation and in the state of Colorado. Our findings indicate that implementation of the *General Engineering + CU Teach* degree program would place a highly innovative, nationally-replicable model at CU-Boulder that couples an ABET-accredited General Engineering degree with secondary math or science teacher licensure. To date, only the University of Tennessee-Chattanooga has a formal degree program that integrates an ABET-accredited engineering degree with a UTeach teacher licensure program; however, it does not offer a flexible General Engineering option.

Colorado State University is the only school we discovered in our benchmarking of Colorado programs that offers an ABET-accredited engineering degree coupled with a teacher licensure pathway; however, it does not have a General Engineering degree program option and only license teachers in technology education, not math or science, which have much higher teacher demand by schools throughout Colorado. The Colorado School of Mines offers a B.S. degree in engineering, with specialties in selected fields such as electrical and mechanical engineering. It is transitioning to traditional degrees (B.S. in Electrical Engineering, B.S. in Mechanical Engineering, etc.) and does not offer a B.S. in General Engineering. Indeed, *no university in Colorado currently awards B.S. degrees in General Engineering.*

Effect on Other Programs-- The anticipated impact of the *General Engineering Plus* degree program on other programs at the University of Colorado is modest. Within the College of Engineering and Applied Science (CEAS), we estimate that approximately 15-16 new core course sections will be required each year. This estimate is made by including two sections of the projects-based GEEN 1400, 2400, 3400, and 4400, which are limited to 30 students per section and one section for each of the other core courses (which can normally hold 50-60 students per section). In addition, 6-7 new course sections will be needed per year for the emphasis courses, distributed across the different disciplines depending on student selections of emphasis disciplines. We plan to offset this impact by the gradual addition of five full-time faculty positions. In addition to teaching GE+ design courses, General Engineering faculty will also teach gateway engineering science courses (such as thermodynamics, statics, etc.) that are included in the "engineering core" for all General Engineering students.

The College of Arts and Sciences will teach math, science, humanities and social sciences courses to General Engineering students. The School of Education will teach education courses for those students in the CU Teach Engineering track. The School of Business will teach those students who select a business sequence (or minor) for their purposeful electives.

Effect on Existing Resources-- The proposed *General Engineering Plus* degree program is not anticipated to affect the University Library. As the new degree program reaches its anticipated enrollment of ~180 students within 4-5 years, we expect the primary impact on existing resources to be in the arena of product fabrication. As it is a design-focused degree, General Engineering students will become competent in more and more sophisticated product design and development. This focus will add demand to fabrication resources in the ITL Laboratory – such as the Electronics Center and Manufacturing Center. And, the design classrooms in the ITL Laboratory will be pushed beyond capacity with the addition of ~180 students/year filling the equivalent of six sections of existing and new hands-on design courses annually.

Space Estimates-- We do not anticipate an immediate need for new space in order to launch the proposed General Engineering degree. However, within a couple of years, the design classrooms in the ITL Laboratory will be beyond capacity. Expansion of the ITL Laboratory by ~12,000 ft 2 is part of the college's growth plan to accommodate 1,000 additional undergraduate engineering students by 2020. And, repurposing of space in the Fleming building, already proposed by the engineering college, to support design needs will be utilized by GE+ students.

Personnel Needs --The *General Engineering Plus* program will initially be led by the Associate Dean for Inclusive Excellence. Our intention is to appoint a Faculty Director by the 2014-15 academic year. To meet the instructional needs of the GE+ program including both engineering core courses and discipline emphasis courses, the College of Engineering and Applied Science anticipates hiring two new tenure-track faculty members and three full-time instructors. The School of Education will hire a Master Teacher for the CU Teach Engineering track. Four additional graduate student teaching assistants and/or undergraduate learning assistants will be needed within four years to aid in supporting the class sections.

Administrative support needed for the program includes one administrative assistant to aid in the management of the overall program, and a part-time coordinator for the CU Teach Engineering track. One new advisor position will be required for the program because: 1) an almost infinite number of "+" options are available to students, and each must be evaluated for sophistication of content sequencing – and must be pre-approved; and 2) many variations of core courses can be taken in 2-4 departments; therefore, helping students choose the most appropriate course will require a higher touch. Thus, one new advisor position, to be housed in the College of Engineering and Applied Science, will directly be responsible for the academic advising of all students enrolled in the proposed *General Engineering Plus* B.S. degree program.

Space Needs --A design studio of approximately 1,500 ft2 will be required for the General Engineering design courses. In addition, space within the College of Engineering and Applied Science will be required to house the five new faculty members, an advisor, administrative staff and graduate teaching assistants.

Source of Funds-- Funding for this new degree program will be provided from a portion of the tuition resources from the students enrolled in the program.